gone through all the contributions of previous writers, but also to have entered personally upon a most elaborate investigaion of the anatomy of the reproductive organs in the different forms of these insects. This portion of Mr. Buckton's work is particularly valuable.

The succeeding section, relating properly to fossil Aphides, is rather discursive, and strikes us as perhaps hardly in place in connexion with a Monograph of British Aphides. The author here enters more or less into a discussion of the occurrence of fossil insects in sedimentary rocks and in amber, and finally describes and figures the Aphides occurring in the latter, those determined by Heer from the Tertiary deposits of Œningen and Radoboj, and finally the species obtained by Mr. Scudder from the Tertiary basin of Florissant, in the Colorado region. The last-mentioned forms have been determined and named by Mr. Buckton from Mr. Scudder's drawings.

The volume concludes with some practical remarks on natural and artificial checks to the increase of Aphides, and on preserving and dissecting these minute and delicate insects, which will prove of great service to intending students of the group, whose number we hope may be greatly increased by the facilities which Mr. Buckton's labours have offered to them in his present work. His carefully prepared descriptions and figures place in the hands of students a ready means of working out whatever is already known of the British forms of one of the most interesting and curious groups of insects, a group many members of which, from their wonderful fecundity, are among the most formidable foes of the farmer and the gardener, and which thus has as it were a double claim to our notice. In conclusion, we would heartily congratulate Mr. Buckton upon the completion of his work, which, although we know it to have been a labour of love, must nevertheless have tasked his energies severely.

MISCELLANEOUS.

On the Development of Balanoglossus. By William Bateson, Cambridge, England*.

An unlimited quantity of this remarkable form was easily to be obtained at half-tide all along the shores in the neighbourhood of Hampton, Virginia. The difficulties attending the investigation were far less than those that have been previously met with at other localities. Since the time during which I have been able to remain in America was exceedingly limited, I thought it best to confine my work at Hampton to the study of fresh specimens of the animal, and to the task of collecting and preserving them for subsequent

* Note from the 'Chesapeake Zoological Laboratory,' 1883.

examination by means of sections. My observations are therefore very meagre and inadequate, especially as regards the organogeny of the form, owing to the extreme scarcity of the larvæ. These important deficiencies I hope subsequently to supply when I shall have been able to examine my material by sectional methods. The general appearance of the Hampton form presents many points of slight divergence from the species common at Naples (*B. minutus*), so that at first sight the two animals seem very different; but whether the anatomy of this form is essentially different, I could not decide by examination of fresh specimens alone. The principal result of my work has been to show that the form common on the Chesapeake coast does not pass through the Tornaria stage, which has been described by previous observers as the larva of *Balanoglossus*. The eggs of this animal are opaque, yellowish-grey bodies, enclosed in a thin tough egg-shell which is quite transparent. Segmentation is begun by the appearance of a median furrow which divides the egg into two equal halves. This is followed by another median furrow at right angles to the first, forming four segments. In the next stage that I have been able to observe segmentation was complete, having probably proceeded in a regular manner, though this I have not been able to determine. One edge of the blastoderm is next flattened and gradually depressed, causing the embryo to take the shape of a concavo-convex disk. The concavity becomes gradually reduced in size as its edges grow together to form the blastopore, appearing at the same time to become thickened. This process is continued until the blastopore becomes exceedingly small; whether it subsequently disappears or not I cannot say until I have cut sections of it. I believe, however, that it becomes the anus, which at all events is found in the same position. As this gastrula becomes shut off it resumes the spherical shape and begins to rotate about the axis which eventually becomes the long axis of the animal, at the top of which the blastopore is placed. This rotatory movement is caused by a uniform covering of fine cilia. After rotating in this way for some few hours, the body elongates and a ring of large cilia appears surrounding the posterior end. The animal then swims round the egg, rotating at the same time on its long axis. A nearly median transverse constriction next occurs, which is followed by another one anterior to it, giving the body the appearance of being composed of three segments. The anterior segment becomes the proboscis, the middle one forms the collar, and from the posterior portion the rest of the body is developed. Within the anterior constriction the mouth is subsequently formed. At the anterior end of the proboscis a tuft of fine long cilia grows out as in the larvæ of many Chætopoda, &c. A pair of depressions are at the same time formed posteriorly to the collar in a dorsal position. These depressions form the first pair of gill-slits. In this condition the larva is generally hatched, though I have found individuals already free before the appearance of the transverse constriction. On hatching these larvæ are still quite opaque, and live buried in the muddy sand which the adults inhabit. In this con-

dition the animal remains for some time, increasing in size, until it is about an eighth of an inch long, the proboscis being about half the total length of the body. The tip of the proboscis is used by the larvæ to attach themselves by suction to foreign bodies, though apparently no special suctorial organ exists. As the body grows, the posterior band of cilia becomes wider and the cilia themselves longer and coarser, while the direction of the band alters slightly. From the appearance of fresh specimens in this stage, treated with acetic acid, I believe that several pouches arise from the gut which probably are destined to form the other gill-slits; but this is quite uncertain, though of course sections will at once decide this question. I have been unable to procure any specimens older than these, and of the changes by which this larva becomes converted into *Balanoglossus* I can therefore say nothing. Possibly the animal remains in this condition during the winter and awaits the spring for its final development. I hope to be able to observe the subsequent stages at some future season.—*Johns Hopkins University Circulars*, Nov. 1883.

On the Development of the Branchia in the Cephalopoda.

By M. L. Joubin.

The investigations of Kölliker upon the development of the Cephalopoda, while throwing much light upon the embryogeny of those animals, have nevertheless left in obscurity the origin of the organ of respiration. I have set myself, in the laboratories of M. de Lacaze-Duthiers, to fill up this gap by studying principally the *Sepia officinalis*, the eggs of which are easily procured.

The branchiæ of the embryo make their appearance at the beginning of the development in the form of two small buds, situated symmetrically with relation to the antero-posterior plane upon the middle of what will eventually become the posterior wall of the palleal cavity. The bud, produced by a pushing forth of the epithelial layer by the cells of the subjacent layer, soon elongates and forms a small well-differentiated eminence, rounded at the apex and attached by a broad base. I found it impossible, even in the youngest embryos that I could obtain, to ascertain the presence of vibratile cilia upon the branchia, although the palleal cavity is lined with them. The bud afterwards flattens so as to present two surfaces—a posterior one, applied against the visceral mass, and an anterior one, which is subsequently covered by the mantle which bounds the respiratory cavity superiorly.

Upon this little lamina, which is about $\frac{1}{3}$ millim. in length, a first horizontal fold appears towards the middle, then a second nearer to the point, then a third still nearer to the free extremity, and so on.

These folds form depressions upon one of the surfaces corresponding with elevations upon the other surface; the branchial bud has therefore become an undulated lamina; gradually other folds appear, always towards the point, while the whole organ at the same time increases in dimensions, so that a length of $1\frac{1}{2}$ millim. corresponds with a dozen folds. But the latter do not occupy the whole surface